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EPIDEMIOLOGY AND SYMPTOMATOLOGY OF AN OUT-BREAK OF SEPTIC SORE-THROAT IN WESTCHESTER COUNTY, NEW YORK *

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The first outbreak of septic sore-throat studied in America was the epidemic in Eastern Massachusetts described by one of us in 1912.¹ Since that time a number of other outbreaks have been reported: at Chicago, by Miller and Capps;² at Boston, by Coues;³ at Baltimore, by Frost;⁴ at Concord, N. H., by Mann;⁵ at Cortland and Homer, N. Y. by North, White, and Avery;⁶ at Middlebury College, Vt., by Eddy;⁷ and at Rockville Center, N. Y., by Overton, Krumwiede, and Jaques.⁸

In most of these cases the disease was spread chiefly by unpasteurized or imperfectly pasteurized milk. It has of course been recognized by all who have studied this disease that it may be, and is, transmitted not only by milk, but also by contact. In the Eastern Massachusetts outbreak the milk epidemic in Boston and its suburbs was preceded by prosodemic spread in Hudson, Marlboro, and Southboro; while at Baltimore the milk epidemic was followed by a prosodemic outbreak. Yet the emphasis on milk as a causal factor has been almost overwhelming in all these cases. In view of this fact the present outbreak, chiefly prosodemic in nature, may be of interest to epidemiologists.

THE WESTCHESTER COUNTY OUTBREAK

Septic sore-throat has been a reportable disease in the state of New York since May 1, 1914, but its reporting is still very incomplete. When it appeared in March, 1915, that there was an unusual prevalence of this

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¹ Jour. Infect. Dis., 1912, 10, p. 73.

² Jour. Am. Med. Assn., 1912, 58, p. 1848.

³ Am. Jour. Pub. Health, 1912, 2, p. 419.

⁴ Pub. Health Rep., 1912, 27, p. 1889.

⁵ Jour. Infect. Dis., 1913, 12, p. 481.

⁶ Ibid., 1914, 14, p. 124.

⁷ Bull. Vermont State Board of Health, 1914, 14, p. 25.

⁸ Bull. New York State Dept. of Health, 1914, 9, p. 230.

disease in certain municipalities of Westchester County, a special study was undertaken to determine its actual extent and etiology.

Cards calling for the name and address, age and sex of each patient, the date of first visit, and the principal symptoms noted, were printed and distributed to all the physicians in the city of Mt. Vernon and the villages of White Plains, Bronxville, and Tuckahoe, the communities affected. The list of symptoms in regard to which information was specifically requested on the cards was as follows: throat much reddened, false membrane, high temperature (above 102 degrees), prostration, swelling of tonsils, quinsy, cervical glands involved, ears involved, relapses, rheumatism, erysipelas, nephritis. Endocarditis was omitted by an oversight, but was written in on the cards in a few instances. We desire to express our great appreciation of the co-operation of the physicians of Mt. Vernon, White Plains, Bronxville, and Tuckahoe which made this study possible. They responded most cordially to our request for this information, and the returns obtained are believed to be fairly complete.

In all, we obtained reports of 905 cases of septic sore-throat in the three communities from January to May: 556 cases in Mt. Vernon (population, 38,000) ; 193 cases in Bronxville and Tuckahoe (combined populations about 5,000) ; and 156 in White Plains (population 19,000).

The distribution by weeks and according to milk supply (to which reference will be made later) is shown in Table 1 and Fig. 1. The

TABLE 1
CASES OF SEPTIC SORE-THROAT SUMMARIZED BY COMMUNITIES, BY WEEKS, AND BY MILK SUPPLIES

Dates	Mt. Vernon		Bronxville and Tuckahoe		White Plains		Total	
	Milk Supply		Milk Supply		Milk Supply		Milk Supply	
	Dairy "A"	Others	Dairy "A"	Others	Dairy "A"	Others	Dairy "A"	Others
Before Feb. 15.....	4	20	17	6	3	1	24	27
Feb. 15-21	44	22	8	9	10	3	62	34
Feb. 22-28	84	43	31	14	11	5	126	62
Mar. 1-7	71	43	19	22	10	11	100	76
Mar. 8-14	38	44	12	22	10	8	60	74
Mar. 15-21	30	22	9	6	5	3	44	31
Mar. 22-28	15	20	6	6	6	6	27	32
Mar. 29-Apr. 4.....	3	10	...	4	1	4	4	18
Apr. 5-11	7	11	...	1	7	7	14	19
Apr. 12-18	2	8	...	...	3	1	5	9
Apr. 19-25	...	2	1	...	2	2	3	4
Apr. 26-May 2.....	2	2	...	...	...	10	2	12
Later or unknown date	...	9	...	...	18	9	18	18
Totals	300	256	103	90	86	70	489	416

chief prevalence of the disease in all three districts was between February 15 and March 29 with a maximum in the week beginning February 22. The fact that the cases occurred in considerable numbers for a period of 6 weeks seems to point toward a spread in prosodemic fashion, rather than in the form of a milk epidemic, since milk epidemics of this disease usually show an overwhelming preponderance of cases during a single week or fortnight.

SEX INCIDENCE

Information as to the sex of the patients is presented in Table 2. Of the 893 cases in which sex was reported, 517, or 58%, were females. This corresponds closely with the results reported in most of the other outbreaks. Of the Boston (milk) cases in Eastern Massachusetts 71% were females and of the Hudson (prosodemic) cases 45%; but at Baltimore, 58% of the cases were females, at Cortland and Homer 57%, at Concord 58%, and at Rockville Center 59%.

TABLE 2
CASES OF SEPTIC SORE-THROAT IN WESTCHESTER COUNTY SUMMARIZED ACCORDING TO SEX

	Male	Female	Unknown
Mt. Vernon	240	306	10
Bronxville and Tuckahoe.....	75	117	1
White Plains	61	94	1
Total	376	517	12

AGE INCIDENCE

The age incidence of 724 cases (Westchester County) in which the age was stated is shown in Table 3; and the percentage of the total number of cases of known age at each age period in this outbreak as compared with 4 others in Table 4.

TABLE 3
CASES OF SEPTIC SORE-THROAT IN WESTCHESTER COUNTY SUMMARIZED ACCORDING TO AGE

Age Not Stated	Under 11 yr.	11-20 yr.	21-30 yr.	31-40 yr.	41-50 yr.	51-60 yr.	Over 60 yr.
181	181	119	146	153	81	30	14

The Baltimore outbreak was marked by a heavy prevalence of cases (53%) at ages under 10 years, and the Concord outbreak shows

an excessive incidence at ages from 21 to 30. The other three sets of figures indicate a fairly even distribution of cases over the various age periods, as in the Eastern Massachusetts outbreak.

TABLE 4
AGE DISTRIBUTION OF CASES OF SEPTIC SORE-THROAT IN VARIOUS OUTBREAKS

Outbreak	Percentage of Total Number of Cases of Known Age at Each Age Period						
	Under 11 yr.	11-20 yr.	21-30 yr.	31-40 yr.	41-50 yr.	51-60 yr.	Over 60 yr.
Westchester County.....	25	16	20	21	11	4	2
Baltimore.....	53	12	15	10	6	2	3
Cortland-Homer.....	15	16	18	19	13	8	12
Rockville Centre.....	29	13	22	20	9	3	5
Concord*.....	.. 18		42		22 ..	.. 18	

* Town population excluding cases in large schools.

SYMPTOMATOLOGY

The data obtained by us in regard to symptomatology are somewhat more extensive than those previously published. The relative proportion of cases in which each symptom was noted is indicated in Table 5, according to milk supply (reference to this point will be made later), and in Table 6, according to age.

TABLE 5
SYMPTOMATOLOGY OF SEPTIC SORE-THROAT IN WESTCHESTER COUNTY

Symptom	Percentage of Total Cases Showing Each Symptom		
	Customers of Dairy "A"	Other Cases	Total Cases
Reddening of throat.....	83	84	83
False membrane.....	20	20	20
High temperature.....	41	32	37
Prostration.....	48	45	47
Tonsils enlarged.....	62	58	60
Quinsy.....	12	6	9
Glands involved.....	53	46	50
Ears involved.....	8	6	8
Relapses.....	7	7	7
Rheumatism.....	12	10	11
Erysipelas.....	2	2	2
Nephritis.....	3	2	3
Endocarditis.....	0.4	0.4	0.4

Reddening of the throat was almost universal, being reported in 83% of 905 cases. Enlargements of tonsils and glands were noted in about half the cases (60% and 50% respectively). Marked prostration was reported in 47% of the cases, and a temperature of over 102 degrees in 37% of cases. Formation of false membrane was less com-

mon than is often the case in such outbreaks—observed in only 20% of our cases. Among the rarer complications were quinsy (9%), involvements of the ears (8%), nephritis (3%), erysipelas (2%), and endocarditis (0.4%). The last figure is perhaps too low, since no place was provided for this entry on our card. Seven percent of all cases suffered from relapses.

TABLE 6
SYMPTOMATOLOGY OF SEPTIC SORE-THROAT AT DIFFERENT AGE PERIODS IN THE WESTCHESTER COUNTY OUTBREAK

Symptom	Percentage of Cases at Each Age Period Showing Each Symptom						
	Under 11 yr.	11-20 yr.	21-30 yr.	31-40 yr.	41-50 yr.	51-60 yr.	Over 60 yr.
Reddening of throat.....	87	86	93	94	86	93	93
False membrane.....	20	24	20	33	15	20	7
High temperature.....	44	37	38	46	44	50	57
Prostration.....	42	43	56	64	58	80	64
Tonsils enlarged.....	60	68	73	69	61	63	57
Quinsy.....	0.6	5	16	13	9	33	0
Glands involved.....	63	58	51	48	44	50	14
Ears involved.....	15	6	8	9	3	7	7
Relapses.....	6	5	8	8	15	16	0
Rheumatism.....	2	7	10	21	26	20	7
Erysipelas.....	0	1	0	1	1	7	14
Nephritis.....	0.6	3	3	3	5	10	7
Endocarditis.....	0.6	1	1	0	0	3	0

The distribution of symptoms by ages (Table 6) is of considerable interest. It will be noted that the symptoms which may be held to measure the general severity of the disease, such as high temperature, prostration, relapses, rheumatism, erysipelas, and nephritis, tend to increase in frequency with advancing years; on the other hand, involvements of the glands and ears are most common in young persons.

THE CAUSE OF THE OUTBREAK

Communicable diseases may be considered for practical purposes to be spread in 3 ways—by contact, by articles of food and drink, and by insects. Septic sore-throat has never been connected with an insect carrier, and the season and the habits of the affected population make it unnecessary to consider this factor in Westchester County. So far as water and food supplies other than milk and cream are concerned, none of these, so far as we are aware, is distributed to the three sections of Westchester County affected which is not also distributed elsewhere. The inquiry very soon, therefore, narrowed itself down to the two factors, contact and milk.

The general distribution of the disease in time, as noted above, was such as to suggest prosodemic spread by contact rather than an epidemic due to milk. There is, however, one large dairy company, and only one, which supplies a large portion of the population of all three of the communities affected; and the possible connection of this dairy with the outbreak demanded study.

Through the courtesy of the managers of the dairy company in question we were given free access to its records. Each address from which a case of septic sore-throat had been reported was compared with the delivery route books to see whether milk was delivered there by the "A" company or not. This method, the same one which was pursued in the Boston outbreak, is of course open to obvious errors in individual cases. There are, on the one hand, members of families in which milk is bought who do not drink it; and, on the other hand, there are those who may have drunk infected milk while visiting at the homes of others. On a broad scale and for comparative purposes, however, such a study yields all the data really necessary; and its results are probably as near the truth as those based on the memories of individuals as to whether they did or did not drink milk during a specified period.

The "A" company furnishes about 45% of the total milk supply of Mt. Vernon, Bronxville, and Tuckahoe, and 54% of the cases of septic sore-throat were among its customers; while in White Plains, where the company supplies 70% of the milk, there were only 55% of the septic sore-throat cases in the houses which it served. These figures seem to furnish clear evidence that the general prevalence of the disease was not due to milk in any large degree, and confirm the inference, drawn from the dates of incidence, that it was the result of spread in prosodemic fashion by ordinary contact.

A study of the time distribution of the "A" cases and the other cases in Table 1 and Figure 1 suggests, however, that the problem may not be an altogether simple one. Between February 15 and March 8, the period when the outbreak was at its height, 63% of the cases in Mt. Vernon, Bronxville, and Tuckahoe were in households served by the "A" dairy, while before and after that period only 44% were in such households. In White Plains during the same three weeks 62% of the cases were in households receiving "A" milk against 52% for the period before and after. Figure 1 shows these facts in graphic form. The fact that between February 15 and March 8 the "A" households

Fig. I

TIME INCIDENCE SEPTIC SORE THROAT CASES
(WESTCHESTER COUNTY)

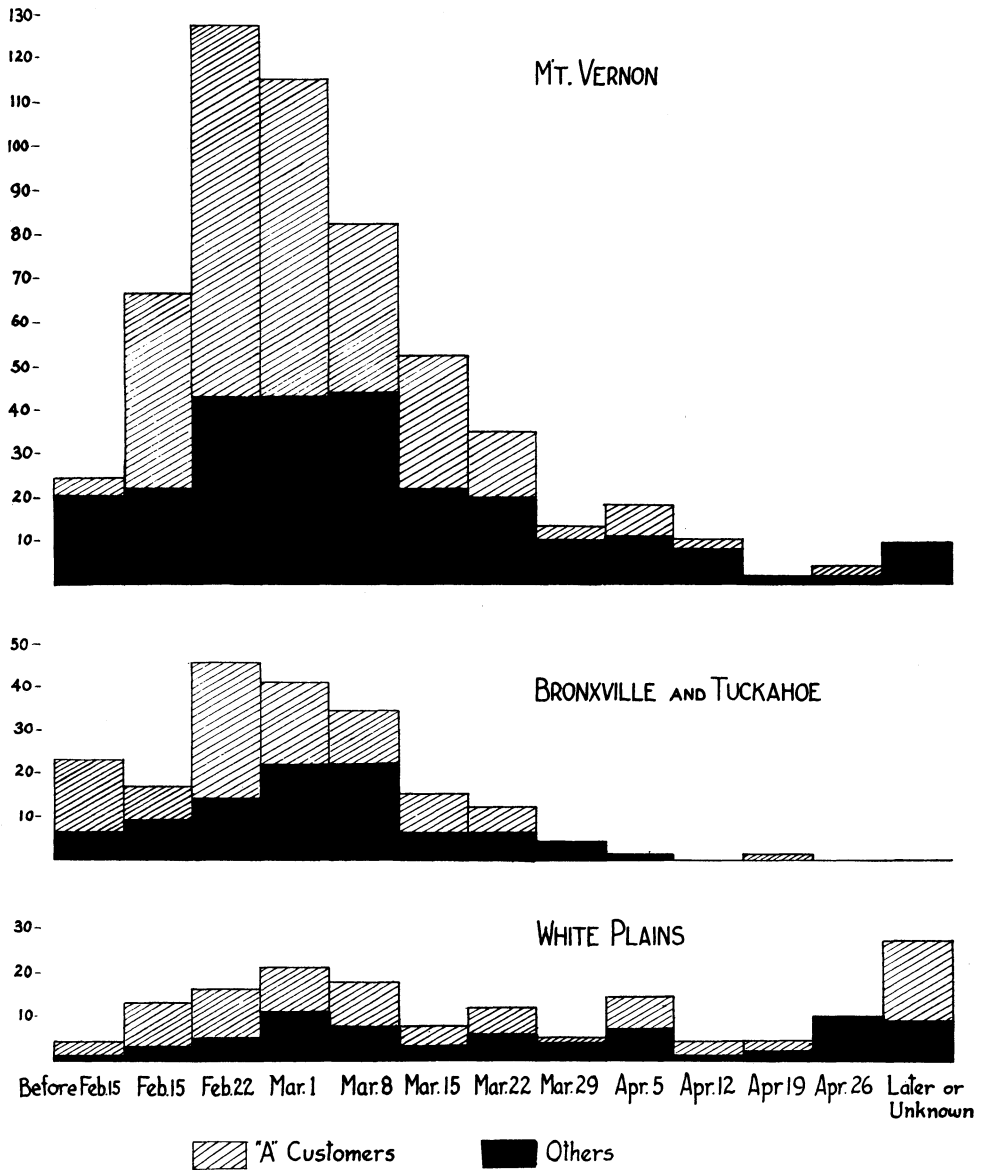


Fig. II

FAMILY INCIDENCE IN SEPTIC SORE THROAT
SPREAD BY MILK AND BY CONTACT

Percentage of Families Having 1,2,3, or more Cases

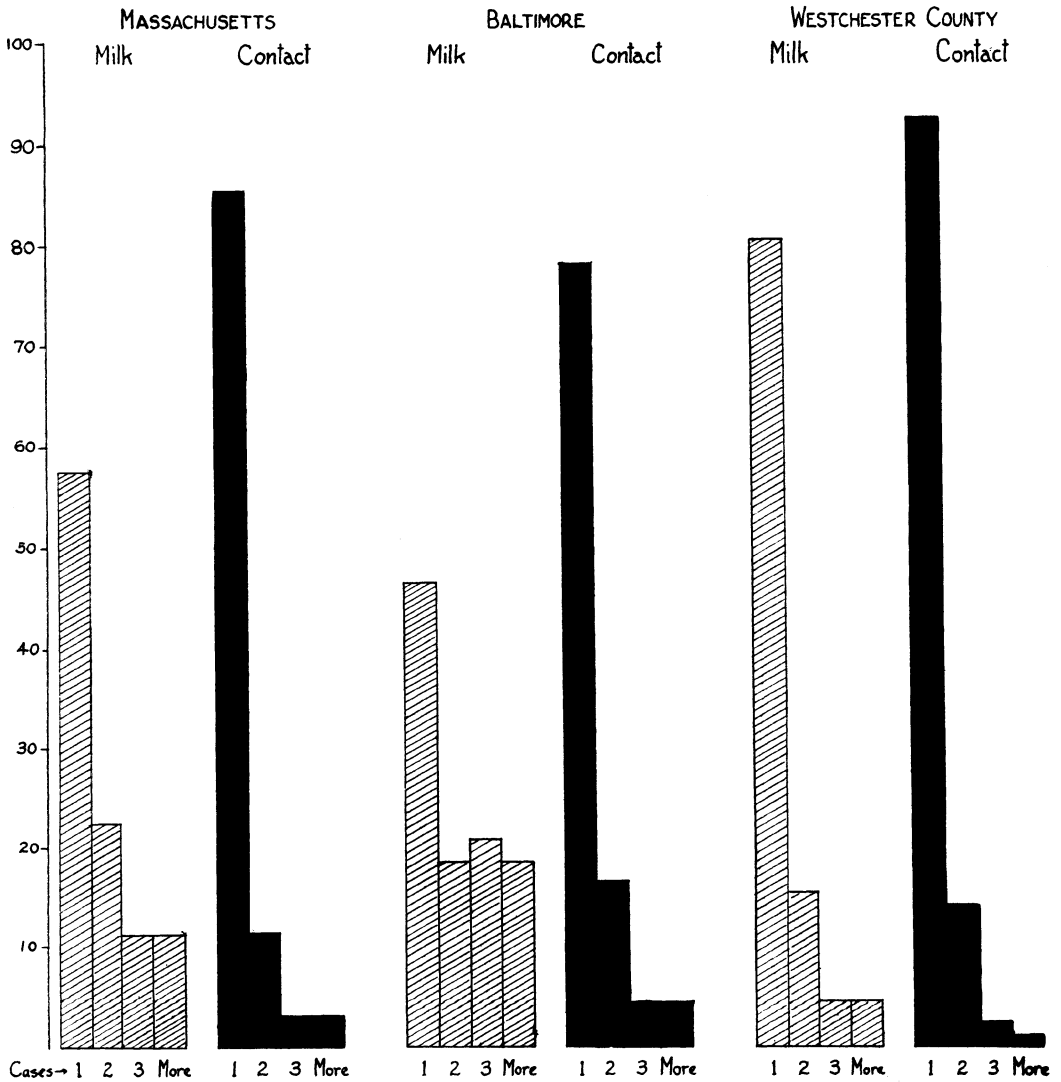


Fig. 2.—The cross-hatched cases in the Westchester outbreak are among "A" customers. Some of these cases, but by no means all, were presumably due to milk infection.

suffered proportionately much more than before and after this period suggests that a small milk or cream epidemic may at this time have been superimposed upon a general prosodemic spread. This hypothesis is strengthened by a comparison of certain characteristics of the groups of cases in the "A" households with those of cases in the other families.

INTENSITY OF FAMILY INCIDENCE

Table 7 shows the general intensity of family incidence in the "A" households and in the other households, and in Table 8 these data are compared with those reported in other outbreaks.

TABLE 7
FAMILY INCIDENCE OF CASES OF SEPTIC SORE-THROAT IN WESTCHESTER COUNTY

Number of Cases in Family	Families		Cases	
	"A" Households	Others	"A" Households	Others
1.....	273	330	273	330
2.....	53	29	106	58
3.....	13	8	39	24
4.....	4	1	16	4
5.....	5		25	
6.....	1		6	
12.....	2		24	
Totals.....	351	368	489	416

TABLE 8
FAMILY INCIDENCE OF CASES OF SEPTIC SORE-THROAT IN VARIOUS OUTBREAKS

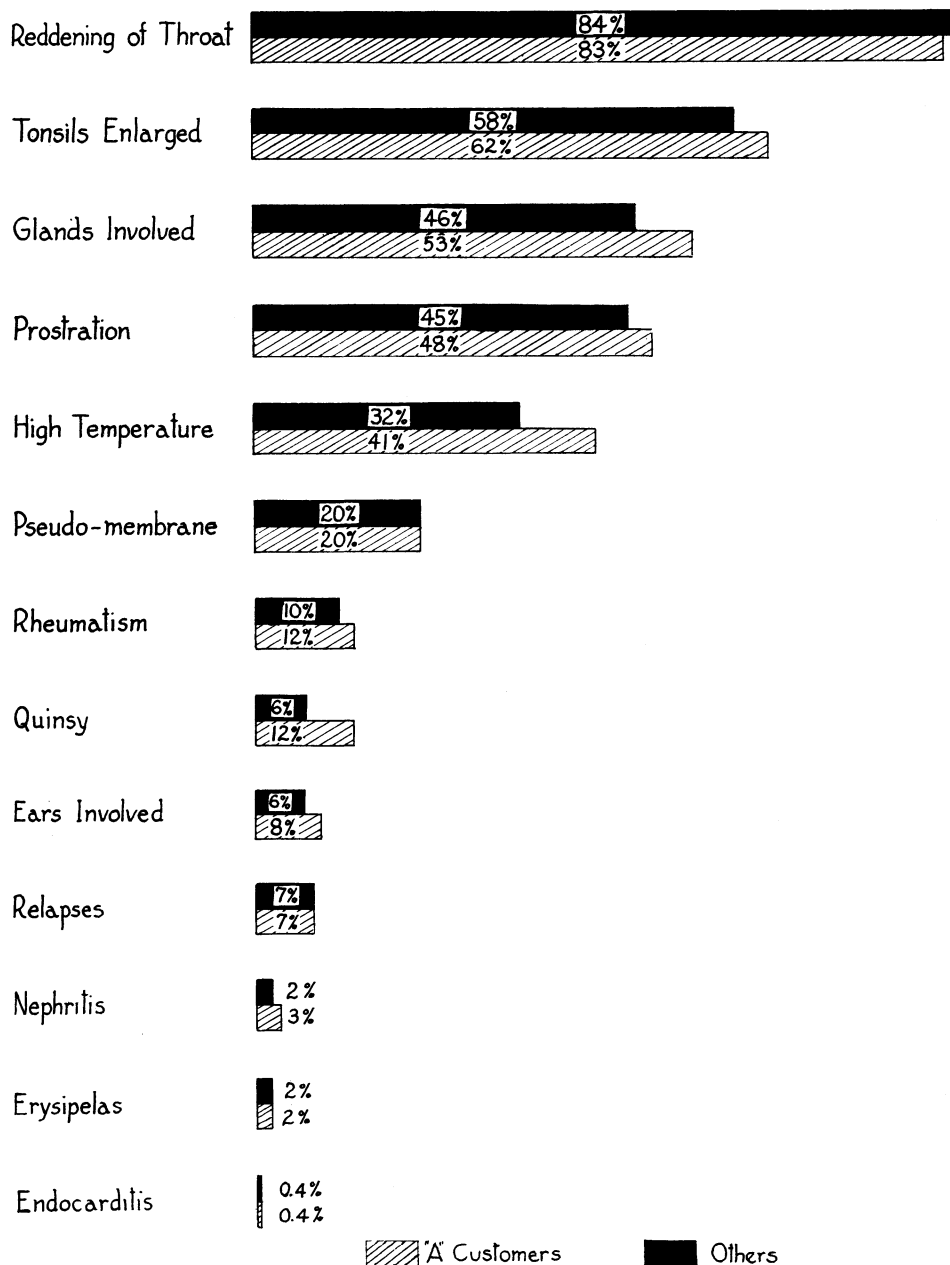
Outbreak	Percentage of Total Families Affected Having			
	1 Case	2 Cases	3 Cases	4 or More
Boston*.....	56	22	11	11
Hudson, Mass.†.....	83	11	3	3
Baltimore, dairy customers*.....	45	18	20	18
Baltimore, others†.....	76	16	4	4
Westchester, dairy customers*.....	78	15	4	4
Westchester, others†.....	90	14	2	1

* Wholly or partly milk infection.

† Wholly contact infection.

Table 8 and Fig. 2 bring out in a striking manner the fact that where septic sore-throat is milk-borne, the proportion of multiple cases in a family is much greater than where the disease is spread by contact, altho the absolute intensity of infection varies with the virulence of the organism in different outbreaks, having been more severe in Baltimore and comparatively mild in the present outbreak. The same observation was made by Miller and Capps in the Chicago outbreak. Among the users of the infected milk there were 2.3 cases to a family, while among

Fig. III
SEVERITY OF SYMPTOMS



other persons the average was 1.2 cases. In the milk outbreak at Concord there was an average of 2 cases to a family. The average for our "A" households was 1.4 cases to a family and for the others 1.1 cases, this again suggesting that a part, altho only a small part, of the outbreak was due to milk or cream infection. It is of interest to note that of 46 instances in which 2 cases developed in a single family on the same day, 33 were in families supplied with "A" milk.

SEVERITY OF THE DISEASE IN RELATION TO MILK SUPPLY

In the Massachusetts outbreak of 1911 the septic sore-throat spread by milk in Boston and vicinity was much more severe than the prosodemic infection in Hudson and adjoining towns from which the milk infection was originally derived. In the Baltimore outbreak Frost noted that the symptoms in milk cases were much more pronounced than those of persons infected by contact. We have analyzed our data from this standpoint in Table 5 and in Fig. 3.

It will be noted that many of the symptoms, notably high temperature, tonsillar and glandular enlargement, quinsy, infection of the ears, rheumatism, and nephritis, were distinctly more common in the "A" households than in the others—another item of circumstantial evidence in favor of the view that the "A" milk or cream did really play a certain part in the spread of septic sore-throat in Westchester County. Careful inquiry, however, failed to locate any frankly infected individual who had come in contact with "A" milk at any stage of its production or distribution. Both milk and cream were mixed supplies derived from a large number of farms and both were delivered raw. Milk infection can of course account only for a small proportion of the entire outbreak, the great majority of cases being undoubtedly of prosodemic origin.

CONCLUSIONS

An outbreak of 905 cases of septic sore-throat occurred in 4 neighboring communities of Westchester County, New York, in the spring of 1915, reaching its maximum between February 15 and March 22.

The distribution of cases of the disease over a long period of time and the absence of any common food or milk supply for a majority of the cases indicates that it was spread, for the most part, by contact and in prosodemic fashion.

The fact that at the height of the outbreak (February 15 to March 8) there was an increase in the proportion of cases in households sup-

plied by a certain milk dealer, that the family incidence in these households was unusually high, and that the severity of the disease in them was accentuated, indicates that a small milk or cream epidemic was then superimposed on the general prosodemic spread of the disease.

Septic sore-throat tends to affect females much more than males. In the five outbreaks which have been reported at Baltimore, Cortland and Homer, N. Y., Concord, N. H., Rockville Center, N. Y., and Westchester County, N. Y., 57-59% of the cases have been females.

Septic sore-throat usually affects all ages without marked preference.

In the Westchester County outbreak 83% of the cases showed reddening of the throat, 60% tonsillar involvement, 50% glandular involvements, 47% prostration, 37% a high temperature (over 102 degrees), 20% false membrane, 11% rheumatism, 9% quinsy, 8% ear infection, 7% relapses, 3% nephritis, 2% erysipelas, and 0.4% endocarditis.

High temperature, prostration, relapses, rheumatism, erysipelas, and nephritis were symptoms more common among the old; involvements of glands and ears, among the young.

When septic sore-throat is spread by contact, multiple cases in a household are less numerous than when it is spread by milk.

Septic sore-throat is generally more severe when milk-borne than when spread in prosodemic fashion.